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# SUSTAINABLE INDUSTRIALIZATION AND STRUCTURAL TRANSFORMATION IN BANGLADESH: FORECASTING PROGRESS TOWARD SDG 9.2

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## ABSTRACT

*Sustainable industrialization constitutes a central pillar of Sustainable Development Goal (SDG) 9.2, which calls for a substantial increase in manufacturing value added (MVA) and its contribution to national output by 2030. Anchored in structural transformation theory and industrial development frameworks, this study evaluates Bangladesh's trajectory toward SDG Target 9.2 by empirically assessing SDG Indicator 9.2.1, comprising (i) manufacturing value added as a share of GDP and (ii) manufacturing value added per capita. In accordance with the 2030 Agenda benchmarks, Bangladesh is required to double its 2015 baseline levels, implying a target MVA share of GDP of 33.576% and MVA per capita of USD 360.96. Using a univariate time-series econometric framework, the study applies the Autoregressive Integrated Moving Average (ARIMA) model to historical macroeconomic data spanning multiple decades. Stationarity properties are verified through unit root testing, and optimal model specifications are selected based on information criteria to ensure robust forecasting performance under a business-as-usual scenario. Projections indicate that by 2030, manufacturing value added as a share of GDP is expected to reach 21.26%, while MVA per capita is forecasted at USD 354.33. Although per capita manufacturing performance approaches the stipulated SDG threshold, the projected GDP share remains substantially below the required benchmark. The findings reveal a persistent structural gap between current industrial growth dynamics and SDG 9.2 commitments, suggesting that incremental growth patterns are insufficient to achieve transformative industrial upgrading. By providing the first forward-looking econometric assessment of Bangladesh's SDG 9.2 performance, this study bridges global SDG monitoring frameworks with national industrial policy analysis. The results underscore the necessity of productivity-enhancing investments, technological upgrading, export-oriented industrial strategies, and institutional strengthening to accelerate structural transformation and achieve sustainable industrial development. These insights contribute to the growing literature on SDG forecasting, industrial competitiveness, and long-run economic transformation in emerging economies.*

**KEYWORDS:** Sustainable industrialization; Structural transformation; Manufacturing value added; SDG 9.2; Time-series forecasting; ARIMA model; Industrial productivity; Bangladesh

**JEL Classifications:** C22, O14, O47, O11, Q01.

## 1. INTRODUCTION

Industrial development is one of the major contributors to economic growth in developing countries. The developing world requires rapid expansion of the industrial sector to accelerate economic growth and increase employment opportunities. The significance of industrialization in economic development and social upliftment is beyond debate in the contemporary global context. A review of the economic history of developed nations clearly reveals a strong industrial foundation. Industrialization is a process of technological, cultural, social, and economic transformation that converts an agrarian society into an industrial one (Chigbo *et al.*, 2016). Such structural transformation drives not only technological advancement but also organizational and institutional innovations (Grubler, 1995). Therefore, industrialization plays a crucial role in economic upliftment, labor productivity enhancement, and substantial increases in national and per capita income (Harley, 2003).

This study focuses on the experience of Bangladesh, a developing country recognized as one of the “Next Eleven” emerging markets (Hoque, 2011). For a country like Bangladesh, industrial development has no viable alternative for accelerating economic growth, particularly in the context of persistent poverty and high unemployment rates (Perspective Plan of Bangladesh 2010–2021). Industrialization is expected to play a critical role in the country’s economic progress in the coming years. The government has planned to expand the industrial sector to enhance productivity and generate higher economic returns. According to the Perspective Plan, by 2021 more than 37 percent of GDP is expected to be generated from the industrial sector, while the contribution of the agricultural sector is projected to decline gradually. This strategy emphasizes a structural shift from agriculture to manufacturing as a means of increasing GDP (Perspective Plan, 2010–2021).

This transition from agriculture to manufacturing is also supported by development economics theory. According to the dual-sector model, commonly known as the Lewis model, economic development is characterized by the movement of labor from the traditional agricultural sector to the modern manufacturing sector, with industrial development acting as a primary driver of GDP growth (Todaro & Smith, 2002).

Despite these growth-oriented strategies, the indiscriminate path of industrial development pursued by Bangladesh over recent decades has generated significant environmental challenges.

Consequently, it is imperative for Bangladesh to formulate policies that balance economic growth with environmental protection to ensure sustainable development and mitigate the adverse effects of unplanned and unsustainable industrialization (Kemper & Fan, 2018). Furthermore, the adoption of the Global Sustainable Development Goals (SDGs) in 2015 by United Nations member states has introduced a new development paradigm (UNDP, 2015). The SDGs consist of 17 goals, 169 targets, and 230 indicators, collectively guiding the global agenda toward inclusive, equitable, innovative, and sustainable development (UN, 2015b).

Within this framework, Sustainable Development Goal 9 specifically addresses sustainable industrialization. For a highly populated country like Bangladesh, SDG target 9.2 is particularly significant, which aims to “promote inclusive and sustainable industrialization and, by 2030, significantly raise industry’s share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries” (Hossain, 2019). Accordingly, Bangladesh’s primary objective under SDG 9.2 is to increase the industrial sector’s contribution to employment and GDP while considering its national development context.

Therefore, sustainable industrialization has emerged as a critical policy concern. As a developing country, Bangladesh must sustain economic growth while creating sufficient employment opportunities for its expanding labor force (Ali *et al.*, 2019). The central challenge lies in increasing the industry’s share of employment and GDP without compromising environmental sustainability. Given the ambitious industrial development plans of the Bangladeshi government, an important question arises: what are the prospects for achieving sustainable industrial development in Bangladesh?

More specifically, what is the likely position of Bangladesh in achieving SDG target 9.2 by 2030 in terms of ensuring inclusive and sustainable industrialization and significantly increasing the industrial sector’s contribution to employment and GDP, in line with national circumstances? This study aims to examine the macro-level prospects for sustainable industrialization in Bangladesh. The primary objective of the study is to assess how close Bangladesh is to achieving SDG target 9.2 by 2030 and to propose relevant policy recommendations to support a sustainable industrialization agenda.

## 2. LITERATURE REVIEW

### 2.1. Structural Transformation Theory

Industrialization has long been recognized as a

central driver of economic transformation. Development theory emphasizes that structural change particularly the reallocation of labor from low-productivity agriculture to higher-productivity manufacturing is essential for sustained economic growth. The dual-sector model, introduced by Lewis (1954), conceptualizes development as a process in which surplus labor from traditional agriculture is absorbed by the modern industrial sector, generating productivity gains and enabling capital accumulation. Building on this foundation, Todaro and Smith (2002) argue that industrial expansion increases output, generates employment, and raises per capita income, while also facilitating technological diffusion and structural diversification. Similarly, Grubler (1995) highlights that industrial transitions extend beyond technological upgrading to include institutional reforms, organizational restructuring, and infrastructural development, all of which are crucial for long-term economic resilience.

Over the past three decades, Bangladesh has experienced a significant structural transformation, gradually shifting from an agrarian economy toward industry and services. Frequently identified as one of the “Next Eleven” emerging economies (Hoque, 2011), the country has maintained sustained GDP growth, with manufacturing as a primary driver. In particular, the ready-made garments (RMG) sector has emerged as the backbone of industrialization, contributing substantially to export earnings, foreign exchange accumulation, and employment generation. The government’s Perspective Plan of Bangladesh 2010–2021 aimed to raise the industrial sector’s share of GDP to over 37 percent while gradually reducing reliance on agriculture (Government of Bangladesh, 2010). This strategic direction aligns with structural transformation theory, positioning manufacturing as a key mechanism for improving productivity, employment, and value addition.

Despite these gains, concerns remain regarding the composition and quality of industrial growth. Empirical evidence indicates that expansion has been concentrated in relatively low-value-added, labor-intensive sectors, with limited technological upgrading and weak sectoral linkages (Ali et al., 2019). Furthermore, the employment elasticity of industrial growth is modest, suggesting that output gains do not consistently translate into high-quality, inclusive employment opportunities (Sultana et al., 2022). Such patterns raise critical questions regarding the inclusiveness, resilience, and sustainability of Bangladesh’s industrialization trajectory.

## 2.2. Industrialization and SDG 9

Sustainable Development Goal 9 (SDG 9) situates industrialization within a multidimensional development framework, emphasizing resilient infrastructure, innovation, and the expansion of productive industrial capacity (United Nations, 2015; UNDP, 2015). Target 9.2 specifically calls for significantly increasing industry’s share of employment and GDP by 2030, particularly in least developed countries (Hossain, 2019). SDG 9 frames industrialization not merely as a mechanism for economic growth but as a process that must simultaneously advance economic productivity, social inclusion, and environmental sustainability (Musa et al., 2024; Hussein, 2024).

Implementation of SDG 9 is typically conceptualized across three interrelated dimensions. The economic dimension emphasizes industrial value added, sectoral GDP contribution, and structural diversification (Akter, 2025). The employment dimension focuses on generating productive and inclusive employment, reducing informal labor vulnerabilities, and promoting equity across gender and skill levels (Sultana et al., 2022; Qi et al., 2025). The environmental dimension highlights resource efficiency, emission intensity reduction, and adoption of cleaner production technologies (Daizy et al., 2021; Musa et al., 2024). These dimensions are interdependent, with progress in one domain capable of reinforcing or constraining outcomes in the others.

The literature emphasizes that achieving sustainable industrialization requires coordinated policy interventions. Industrial upgrading, innovation systems, green financing mechanisms, and robust environmental regulation are critical components of a sustainable industrial strategy (Ali et al., 2019; Musa et al., 2024). Development economists further contend that improvements in governance, infrastructure, human capital, and technological adoption are essential; absent these, rapid industrial expansion can exacerbate environmental degradation and social inequality, undermining long-term gains (Hussein, 2024; Daizy et al., 2021). In the Bangladeshi context, policy discourse increasingly recognizes the need to balance industrial growth with environmental compliance and social inclusion. Yet, empirical evaluations assessing the country’s preparedness to meet SDG target 9.2 by 2030 remain scarce.

## 2.3. Research Gap

Despite extensive research on industrialization and economic growth, several critical gaps remain in

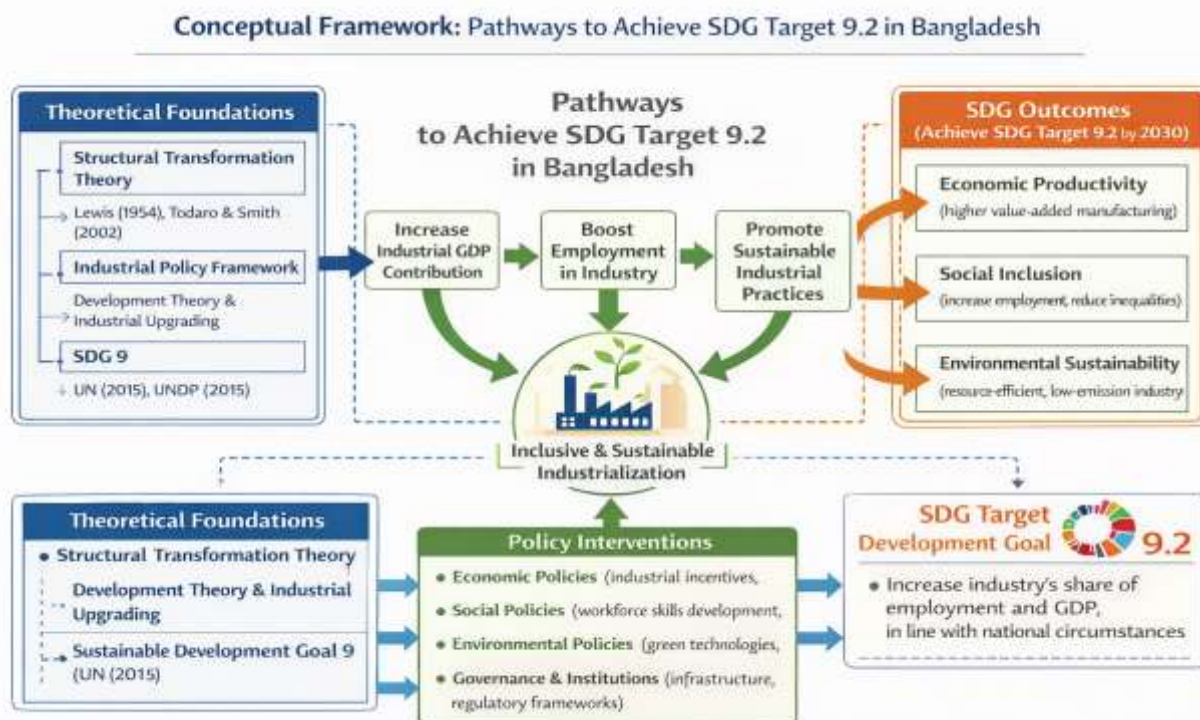
the Bangladeshi context. First, existing studies largely examine GDP growth or sectoral performance in isolation, with few explicitly evaluating Bangladesh’s progress toward SDG target 9.2 using integrated, macro-level indicators aligned with the SDG framework (Hossain, 2019; Akter, 2025). Second, while the industrial sector’s contribution to GDP is well documented, the corresponding share of employment particularly its inclusivity across gender, skill levels, and informal labor remains underexplored (Sultana et al., 2022; Qi et al., 2025). Third, environmental sustainability is often treated as a separate dimension, with limited research linking industrial growth to key indicators such as emission intensity, energy efficiency, and environmental compliance (Daizy et al., 2021; Musa et al., 2024). Fourth, most studies adopt a retrospective or descriptive approach, with few employing forecasting models, scenario analyses, or macroeconomic projections to assess Bangladesh’s likely trajectory toward achieving SDG 9.2 by 2030 (Akter, 2025). Finally, there is a notable absence of a comprehensive, policy-oriented framework that simultaneously integrates structural transformation theory, industrial GDP and employment trends, and sustainability indicators to inform evidence-based decision-making in the Bangladeshi context. Collectively, these gaps highlight the need for a

holistic, forward-looking assessment of sustainable industrialization in Bangladesh.

### 2.4. Conceptual Framework

To address these gaps, this study develops a comprehensive macro-level analytical framework to evaluate Bangladesh’s progress toward SDG target 9.2. By integrating the industrial sector’s GDP contribution, employment share, and key sustainability indicators, the framework provides a unified perspective on the country’s structural transformation. In addition to offering forward-looking projections toward 2030, the study generates actionable policy recommendations aimed at promoting inclusive, environmentally sustainable, and innovation-driven industrial growth. This approach not only enhances the empirical evidence base but also equips policymakers, development planners, and international agencies with a practical roadmap to reconcile economic growth objectives with social and environmental commitments under the SDG agenda. By combining theoretical insights from structural transformation models with contemporary sustainability and SDG considerations, the study contributes both analytically and practically to advancing Bangladesh’s industrial development strategy.

Figure 2.1 Conceptual Framework.



Source: Authors’ creation.

## 2.5. Working Hypotheses

Hypothesis 1: H1: The projected manufacturing value added (as a share of GDP) will increase significantly by 2030 under the continuation of historical trends.

Hypothesis 2: H2: The forecasted manufacturing value added per capita (in USD) will demonstrate a positive growth trajectory up to 2030.

## 3. METHODOLOGY

### 3.1. Data Sources

The nature of the research objectives necessitates the collection and analysis of secondary data. Accordingly, to assess how close Bangladesh is to achieving Sustainable Development Goal (SDG) target 9.2, this study focuses on a single core indicator—SDG indicator 9.2.1, which measures manufacturing value added (MVA) both as a proportion of gross domestic product (GDP) and on

a per capita basis. This indicator is employed to evaluate the country's prospects for sustainable industrial development.

Data for indicator 9.2.1(a), manufacturing value added as a proportion of GDP, were obtained from the World Bank's World Development Indicators (WDI, 2024). Data for indicator 9.2.1(b), manufacturing value added per capita, were collected from the United Nations Industrial Development Organization's (UNIDO) Competitive Industrial Performance (CIP) Index database (2024).

Although manufacturing employment as a proportion of total employment is also a relevant indicator for assessing inclusive and sustainable industrialization, it was excluded from the analysis due to the unavailability of a sufficiently long and consistent time series. Table 3.1 presents the annual data on manufacturing value added as a percentage of GDP in Bangladesh over the period 1960–2019, sourced from the World Bank's World Development Indicators (2024).

**Table 3.1: The annually data of Manufacturing value added percentage of GDP (in percent) in Bangladesh during the period of 1960-2019.**

Year	Manufacturing value added as a percentage of GDP	Year	Manufacturing value added as a percentage of GDP
1960	5.3099	1990	13.2392
1961	5.4706	1991	13.9871
1962	5.4487	1992	14.3975
1963	5.4487	1993	15.4125
1964	5.5140	1994	15.8695
1965	5.4455	1995	15.9000
1966	5.9981	1996	14.0026
1967	5.5829	1997	14.1198
1968	6.1534	1998	14.8598
1969	5.8511	1999	14.3891
1970	5.8047	2000	14.0353
1971	5.4852	2001	14.1784
1972	3.9838	2002	14.3174
1973	8.5218	2003	14.1455
1974	9.2513	2004	14.4421
1975	7.0423	2005	14.7440
1976	9.2839	2006	15.3076
1977	11.2262	2007	15.9341
1978	9.9110	2008	16.1244
1979	9.8615	2009	16.4802
1980	14.4875	2010	16.1212
1981	13.9821	2011	15.9967
1982	13.9391	2012	15.9142
1983	15.0437	2013	16.4420

1984	15.6039	2014	16.6127
1985	14.4581	2015	16.7887
1986	14.2232	2016	17.0302
1987	13.4738	2017	17.3006
1988	13.4220	2018	17.9581
1989	12.9056	2019	18.9326

Source: The World Bank data set indicators, 2024

In addition, Table 3.2 reports annual data on manufacturing value added per capita (in USD) in Bangladesh for the period 1990–2014, obtained from UNIDO's Competitive Industrial Performance Index (2024).

**Table 3.2: The annually data of Manufacturing value added in per capita (in USD) in Bangladesh during the period of 1990-2014.**

Year	Manufacturing Value Added Per Capita	Year	Manufacturing Value Added Per Capita
1990	44.13	2003	76.5
1991	44.13	2004	80.74
1992	46.31	2005	86.19
1993	49.22	2006	94.33
1994	52.11	2007	103.49
1995	56.11	2008	109.81
1996	58.74	2009	115.94
1997	60.45	2010	122.15
1998	64.31	2011	132.86
1999	65.1	2012	144.35
2000	66.95	2013	157.3
2001	70.18	2014	168.89
2002	72.8		

Source: UNIDO- Competitive Industrial Performance Index, 2024.

### 3.2. Analytical Framework and Time-Series Methodology

The study employs time-series analysis techniques to examine the historical trends of the selected indicators and to assess Bangladesh's progress toward SDG target 9.2. Furthermore, an econometric forecasting approach is adopted to project future trends under the assumption that current patterns continue. Specifically, the Autoregressive Integrated Moving Average (ARIMA) model is used to forecast manufacturing value added indicators up to the year 2030 in order to evaluate Bangladesh's likely position in achieving SDG 9.2.

The ARIMA model was introduced by Box and

Jenkins in the early 1970s and is widely applied for medium- to long-term time-series forecasting (George et al., 2008). The model combines autoregressive (AR) and moving average (MA) components, along with differencing to ensure stationarity of the series.

The general form of the Box-Jenkins ARIMA model can be expressed as:

The simple Box- Jenkins (Auto Regression Investigate Moving Average) model:

$$W_t = \phi_1 W_{t-1} + \phi_2 W_{t-2} + \dots + \phi_p W_{t-p} + a_t - \theta_1 a_{t-1} - \dots - \theta_q a_{t-q}(1)$$

Where,

$\phi$  and  $\theta$  = unknown parameters

$a$  = independent and identically distributed normal errors with zero mean,

$P$  = the number of lagged values of  $W_t$ , it represents the order of autoregressive (AR) dimensions,

$I$  = the number of times  $w$  is differenced,

$Q$  = the number of lagged values of the error terms representing the order of moving average (MA) dimension of the model.

This integrated term presents that to get a forecast for  $W_t$ , it is essential to integrate the forecast  $W_t$ . (George, et. al., 2008).

### 3.3 Working Hypotheses (Aligned with ARIMA Specification)

$W_t^{(1)}$  = Manufacturing Value Added as % of GDP

$W_t^{(2)}$  = Manufacturing Value Added per capita (USD)

Hypothesis 1 (Industrial GDP Share)

Null Hypothesis ( $H_0$ ):

$$E(\Delta^d W_t^{(1)}) = 0$$

Manufacturing value added as a percentage of GDP does not exhibit a statistically significant upward trend through 2030.

Alternative Hypothesis ( $H_1$ ):

$$E(\Delta^d W_t^{(1)}) > 0$$

Manufacturing value added as a percentage of GDP exhibits a positive and statistically significant growth trajectory through 2030 under the ARIMA forecast.

Hypothesis 2 (Manufacturing Value Added per Capita)

Null Hypothesis (H0<sub>2</sub>):

$$E(\Delta^d W_t^{(2)}) = 0$$

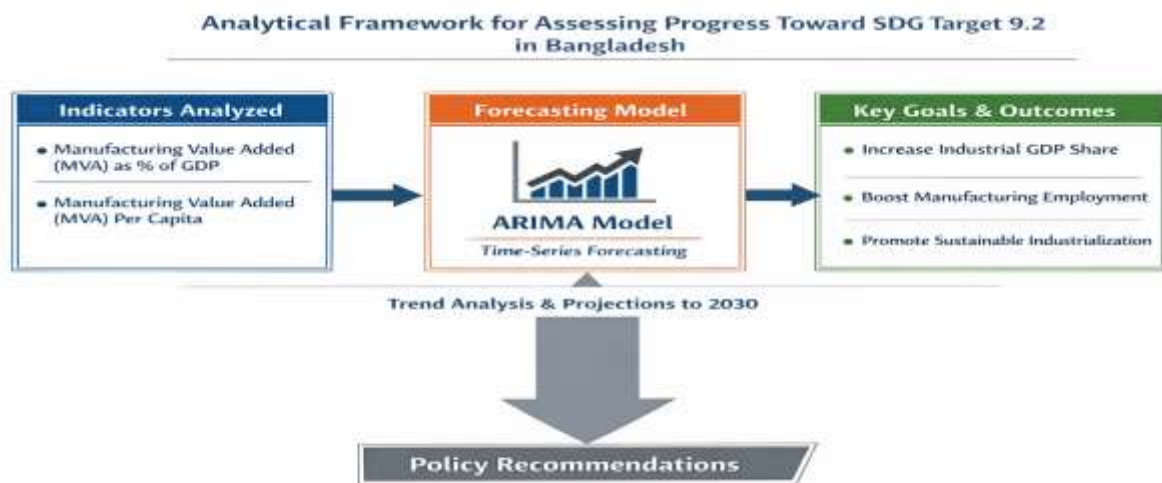
Manufacturing value added per capita does not demonstrate significant growth through 2030.

Alternative Hypothesis (H1<sub>2</sub>):

$$E(\Delta^d W_t^{(2)}) > 0$$

Manufacturing value added per capita follows a positive and sustained growth path through 2030 as projected by the ARIMA model.

Figure 3.1 Analytical Framework.

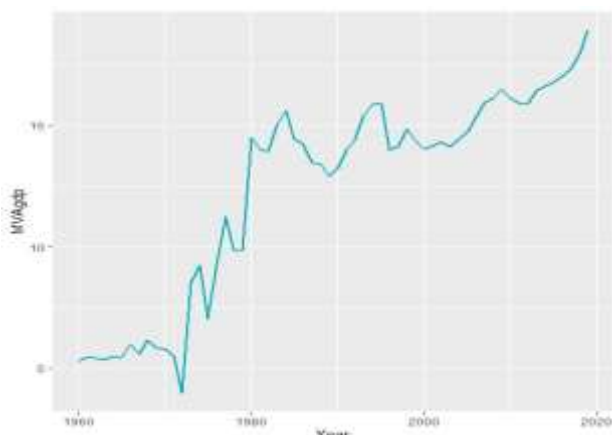


### 4 RESULT AND DISCUSSION

#### 4.2.1 Forecasting the values of the Manufacturing value added (percentage of GDP) in Bangladesh (in percent)

Figure 4.1 presents the variables used in the analysis, which is the annual data of the manufacturing value added percentage of GDP in Bangladesh (in percent) represent a sample size 60 observations from 1960-2019. These 60 observations were used for estimation of the forecasted values.

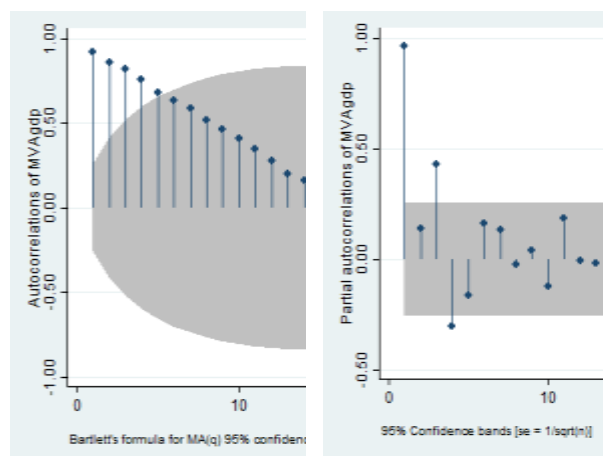
Figure 4.1: The annually data of Manufacturing value added percentage of GDP (in percent) in Bangladesh during the period of 1960-2019.



Source: Compiled by the author from the secondary data.

Figure 4.1 shows increasing trend and which represent that the used time series data is non-stationary. After that for defining the distribution of sample data autocorrelation functions (ACF) and partial autocorrelation functions (PACF) were applied in this study. The values of the ACF are gradually declining from auto correlation coefficient to the end. Here the PAF represents a large peak at lag 1 with a quick decline thereafter, which represents a highly persistent autoregressive structure in the series.

Figure 4.2 ACF and PACF of Manufacturing value added percentage of GDP (in percent) in Bangladesh during the period of 1960-2019 from left to right.



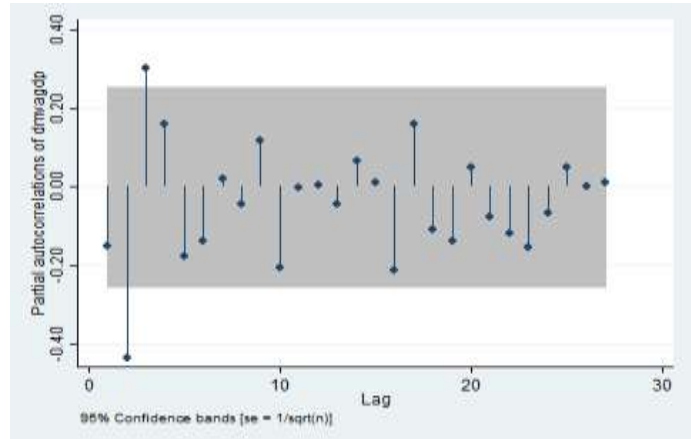
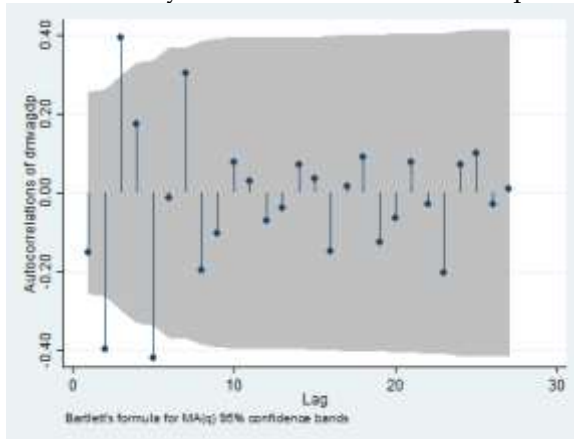
Source: Compiled by the author

**Table 4.1. Dickey-Fuller test for unit root of the annually data of Manufacturing value added percentage of GDP (in percent) in Bangladesh during the period of 1960-2019.**

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.107	-3.567	-2.923	-2.596
MacKinnon approximate p-value for Z(t)=0.7125				

Source: Compiled by the author

Then the stationary unit root test is done and for this data Dickey Fuller test is used. Table 4.1 presents



Source: Compiled by the author

**Table 4.2 Dickey-Fuller test for unit root of the annually data of Manufacturing value added percentage of GDP after 1st differencing.**

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-8.689	-3.569	-2.924	-2.597
MacKinnon approximate p-value for Z(t)=0.0000				

Source: Compiled by the author

After receiving stationary, this study applied Auto ARIMA to get the forecasted value of the

the p value=0.7125; fail to reject the null hypothesis (H0), the data have a unit root and is non-stationary. Figure 4.3 presents ACF and PACF the transformed series. To taste stationary we applied Dickey Fuller test (unit root). Table 4.2 presents the p-value=0.0000 and while the p value was statistically significant and reject the null hypothesis (H0), the data does not have a unit root and is stationary.

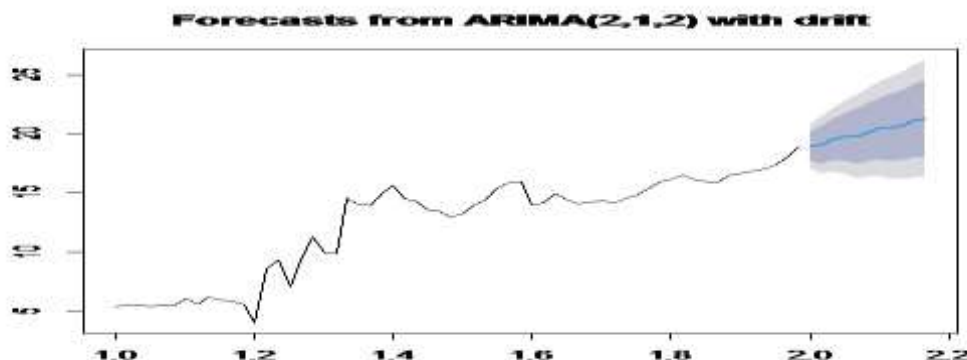
Figure 4.3 ACF and PACF of Manufacturing value added percentage of GDP (in percent) in Bangladesh after 1st differencing 1960-2019 from left to right.

**Table 4.3 Forecasted values with ARIMA of the annually data of manufacturing value added percentage of GDP from the 2020-2030.**

Year	F_value	Lower limit 95%	Upper limit 95%
2020	18.94	17.05	20.83
2021	19.04	16.59	21.50
2022	19.5	16.83	22.18
2023	19.72	16.62	22.82
2024	19.77	16.22	23.31
2025	20.09	16.33	23.85
2026	20.42	16.43	24.41
2027	20.52	16.19	24.86
2028	20.73	16.16	25.30
2029	21.07	16.32	25.81
2030	21.26	16.27	26.25

Source: Compiled by the author

Figure 4.4 Forecasted values with ARIMA of the annually data of manufacturing value added percentage of GDP from the 2020-2030.



Source: Compiled by the author

The ARIMA-based forecasts indicate that by 2030, manufacturing value added (MVA) as a percentage of GDP in Bangladesh is expected to reach 21.26%, substantially below both the SDG 9.2 benchmark of 33.57% and the national target of 35% (BBS, 2020). This gap highlights a critical challenge: under current trajectories, the industrial sector's contribution to GDP is unlikely to increase sufficiently to meet the targets for inclusive and sustainable industrialization.

From a policy perspective, these findings suggest the need for accelerated industrial development strategies that simultaneously promote higher value-added production, technological upgrading, and sectoral diversification. Policies could include targeted support for capital-intensive and technology-driven manufacturing, export-oriented industrial incentives, and facilitation of small and medium enterprises to broaden the industrial base.

In terms of inclusive growth, the forecasted shortfall underscores potential limitations in generating productive employment across the industrial sector. Expanding MVA alone may not translate into equitable employment unless accompanied by initiatives that enhance labor skills, promote gender inclusion, and improve working conditions. Linking industrial expansion with human capital development is therefore essential to ensure that structural transformation benefits a broad segment of the population.

Regarding sustainability, achieving SDG 9.2 requires balancing industrial growth with environmental compliance. The projected MVA trajectory suggests that, without deliberate integration of green technologies and resource-efficient production practices, industrial expansion

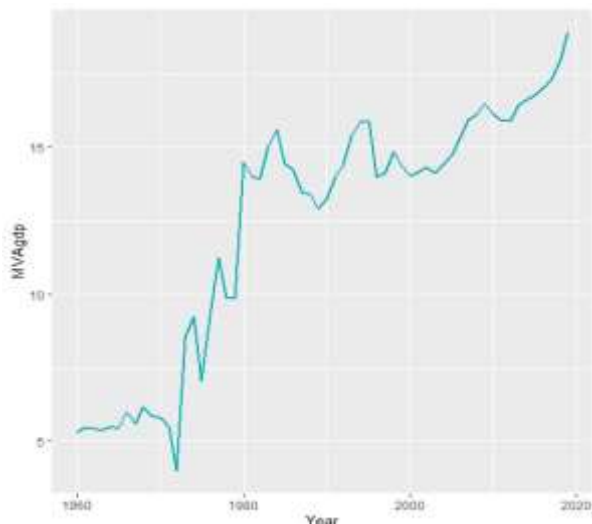
could exacerbate environmental pressures. This emphasizes the importance of eco-innovation, adoption of cleaner production technologies, and regulatory mechanisms to minimize emissions and resource intensity as part of Bangladesh's industrial strategy.

Overall, the gap between projected MVA and the SDG 9.2/national targets highlights the need for coordinated, multi-dimensional interventions. Policies must simultaneously target economic productivity, employment inclusivity, and environmental sustainability to ensure that industrial growth contributes meaningfully to Bangladesh's broader development and SDG agenda. These insights provide a quantitative basis for policymakers and development planners to design evidence-based strategies for accelerating sustainable industrialization over the next decade.

#### 4.2.2. Forecasting the values of the Manufacturing value added per capita (in USD) in Bangladesh

Figure 4.5 presents the variable used in the analysis, which is the annually data of manufacturing value added per capita (in USD) in Bangladesh. This shows a sample size of 25 observations from 1990-2014. These 25 observations were used for estimations of the forecasting values for the manufacturing value added per capita from 2015-2030.

Figure 4.5: The annually data of Manufacturing value added per capita (in USD) in Bangladesh during the period of 1990-2014.

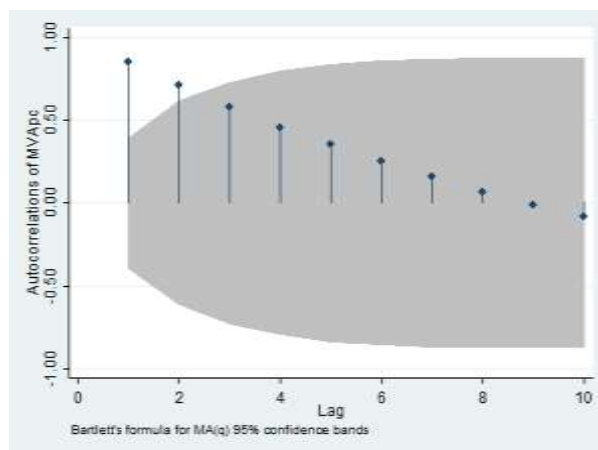
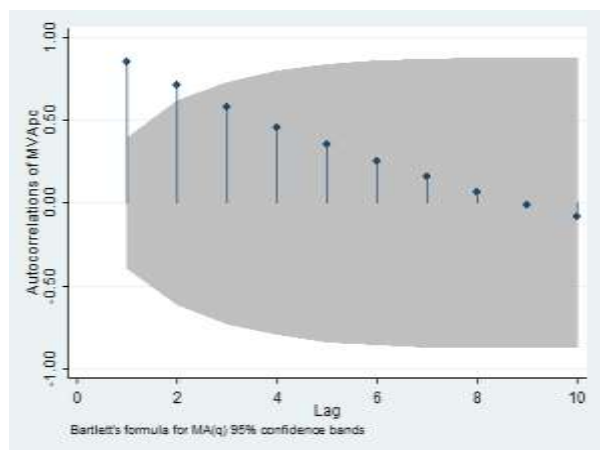


Source: Compiled by the author from the secondary data.

Figure 4.5 represents an increasing trend and indicates that the used time series is non-stationary. After that, for defining the distribution of sample data, autocorrelation functions (ACF) and partial autocorrelation functions (PACF) were applied, which is presented in the figure 4.6.

Figure 4.6 ACF and PACF of Manufacturing value added per capita (in USD) in Bangladesh during the period of 1990-2014 from left to right.

Figure 4.6 ACF and PACF of Manufacturing value added per capita (in USD) in Bangladesh during the period of 1990-2014 from left to right



Source: Compiled by the authors

Table 4.4 Dickey-Fuller test for unit root of the annually data of Manufacturing value added in per capita (in USD) in Bangladesh during the period of 1990-2014.

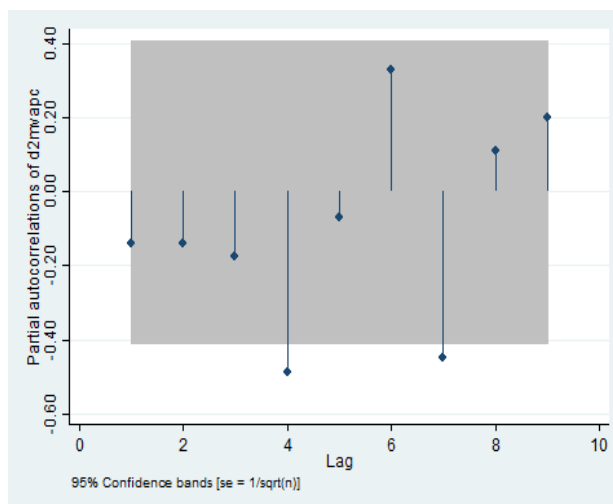
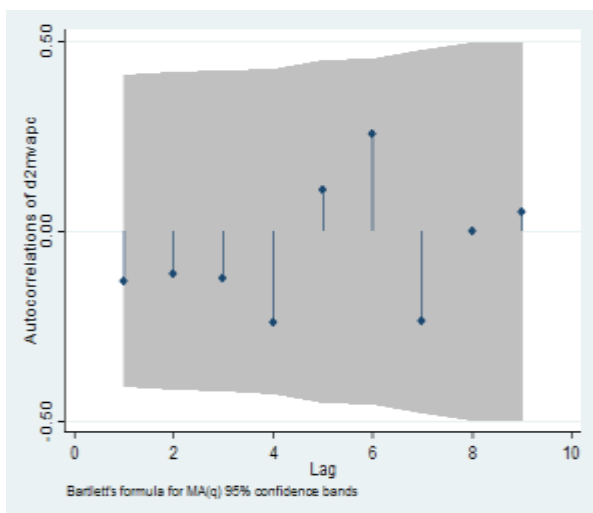
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	10.125	-3.750	-3.000	-2.630
MacKinnon approximate p-value for Z(t)=1.000				

Source: Compiled by the authors

The Dickey Fuller test is applied to check the stationary of the data. Table 4.4 presents the p value=1.000; which fails to reject the null hypothesis (H0), the data has a unit root and is non-stationary. To taste stationary this paper again applied Dickey

Fuller test (unit root). Table 4.5 presents that the p-value=0.7837 and the value also fails to reject the null hypothesis (H0). The data have a unit root and is non-stationary. So, this paper again applied 2nd differencing and table 4.6 presents the p-value=0.0000 and while the p value rejects the null hypothesis (H0), the data does not have a unit root and is stationary. Figure 4.7 presents ACF and PACF the transformed series after 2nd differencing.

Figure 4.7ACF and PACF of Manufacturing value added per capita (in USD) in Bangladesh during the period of 1990-2014 from 2<sup>nd</sup> differencing from left to right.



Source: Compiled by the authors

Table 4.5 Dickey-Fuller test for unit root of the annually data of Manufacturing value added per capita (in USD) in Bangladesh during the period of 1990-2014 after 1st differencing.

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-0.913	-3.750	-3.000	-2.630
MacKinnon approximate p-value for Z(t)=0.7837				

Source: Compiled by the authors

Table 4.6 Dickey-Fuller test for unit root of the annually data of Manufacturing value added per capita (in USD) in Bangladesh during the period of 1990-2014 after 2nd differencing.

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.112	-3.750	-3.000	-2.630
MacKinnon approximate p-value for Z(t)=0.0000				

Source: Compiled by the authors

After receiving stationary of the data, this study applied the Auto ARIMA model to get furcated value of the annually data of manufacturing value added in per capita (in USD) in Bangladesh. Furthermore, the AIC (93.76) and BIC (94.9) values were generated for identifying the approximate combination of parameters. The models with lowest AIC and BIC values were chosen. Then this study forecasted for its future values. Table 4.7 shows that forecasting for the

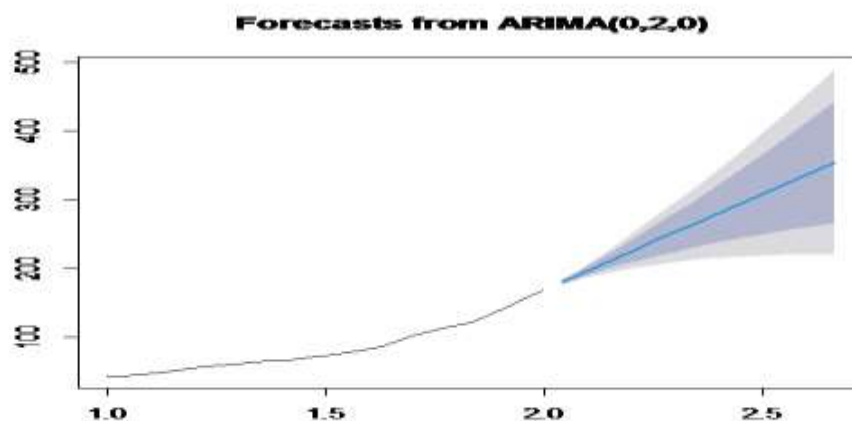
next sixteen years of the annually data of manufacturing value added percentage of GDP.

Table 4.7 Forecasted values with ARIMA of the annually data of manufacturing value added per capita (in USD) in Bangladesh for the period of 2015-2030.

Year	F_value	Lower limit 95%	Upper limit 95%
2015	180.48	176.99	183.96
2016	192.07	184.27	199.86
2017	203.66	190.61	216.70
2018	215.25	196.155	234.34
2019	226.84	200.98	252.69
2020	238.43	205.17	271.68
2021	250.02	208.77	291.26
2022	261.61	211.81	311.40
2023	273.20	214.34	332.05
2024	284.79	216.38	353.19
2025	296.38	217.95	374.80
2026	307.97	219.08	396.85
2027	319.56	219.79	419.32
2028	331.15	220.08	442.21
2029	342.74	219.97	465.50
2030	354.33	219.48	489.17

Source: Compiled by the authors

Figure 4.8 Forecasted values with ARIMA of the annually data of manufacturing value added in per capita (in USD) in Bangladesh from the 2015-2030.



Source: Compiled by the author.

Table 4.7 presents the forecasted manufacturing value added (MVA) per capita in Bangladesh for 2030. The ARIMA-based projection indicates that MVA per capita will reach 354.33 USD, which is closely aligned with the SDG 9.2 target of 360.69 USD, representing a doubling of the 2015 level. This suggests that, in terms of per capita industrial output, Bangladesh is likely to make substantial progress toward the SDG 9.2 objective by 2030.

While the forecasted trajectory for MVA per capita is promising, achieving sustainable and inclusive industrial growth requires more than quantitative output gains. Policy interventions should focus on enhancing productivity, technological upgrading, and sectoral diversification to ensure that growth in per capita manufacturing translates into broad-based economic and social benefits. For example, promoting high-value manufacturing, supporting skill development programs, and incentivizing eco-innovation can strengthen the industrial base while generating higher-quality employment opportunities.

Moreover, the near-target forecast emphasizes the importance of continuity and consistency in industrial policy. Maintaining supportive investment climates, reducing trade barriers, and facilitating access to finance for small and medium enterprises can help sustain the projected trajectory. Integrating environmental sustainability measures, such as cleaner production technologies and resource-efficient processes, ensures that per capita gains are aligned with long-term environmental and SDG

commitments.

In summary, the forecasted MVA per capita indicates that Bangladesh is on track to achieve the SDG 9.2 quantitative target. However, realizing the full developmental potential of this growth requires targeted policies that promote inclusive employment, technological advancement, and environmental sustainability, thereby ensuring that industrial expansion contributes meaningfully to the country's broader economic and social objectives.

## 5. CONCLUSION

This study assessed Bangladesh's macro-level prospects for achieving SDG target 9.2 by 2030, focusing on the industrial sector's contribution to GDP and per capita manufacturing value added (MVA). Using ARIMA-based forecasting, the analysis examined trends in both MVA (% of GDP) and MVA per capita (USD), guided by the working hypotheses:

- H1: Manufacturing value added (% of GDP) will increase significantly by 2030 following historical trends.
- H2: Manufacturing value added per capita will follow a positive growth trajectory up to 2030.

### 5.1 Key Findings

The forecasts present a nuanced picture of Bangladesh's industrial trajectory:

**Industrial GDP Contribution:** By 2030, MVA as a share of GDP is projected to reach 21.26%, markedly below the SDG 9.2 benchmark of 33.57% and the national target of 35% (BBS, 2020). This indicates that, under current trends, the industrial sector alone is

unlikely to achieve the GDP contribution necessary for fully inclusive and sustainable industrialization.

Per Capita Industrial Output: Forecasted MVA per capita is 354.33 USD, closely approaching the SDG 9.2 target of 360.69 USD, effectively doubling the 2015 level. This suggests that, while individual productivity is likely to improve substantially, overall industrial output as a share of GDP may remain insufficient.

Implications for SDG 9.2: The results reveal a mixed outlook. Bangladesh appears well-positioned to achieve per capita gains, but increasing the industrial share of GDP will require deliberate policy interventions. Structural constraints such as the concentration in labor-intensive, low-value manufacturing, and modest productivity improvements pose challenges to broad-based industrial growth.

### 5.2 Recommendations

To bridge the projected gap in industrial GDP contribution while sustaining per capita gains, Bangladesh requires a comprehensive, multi-dimensional strategy. First, industrial upgrading should be accelerated by promoting high-value, technology-intensive manufacturing sectors and supporting digitalization and automation to enhance productivity and value addition. Second, inclusive industrial employment must be strengthened through targeted skill development programs aligned with industry needs, alongside policies that encourage gender inclusion and expand formal employment opportunities across sectors. Third, sustainable industrial growth should be prioritized by incentivizing eco-innovation, adopting cleaner production technologies, and implementing energy efficiency measures to reduce emissions in manufacturing. Finally, policy and institutional support must be reinforced by maintaining investment-friendly industrial policies, reducing bureaucratic barriers, expanding support for small and medium enterprises (SMEs) to diversify the

industrial base, and aligning national industrial targets with SDG objectives to ensure measurable progress through 2030. Collectively, these interventions can accelerate structural transformation, improve productivity, and foster inclusive, environmentally sustainable industrialization in Bangladesh.

### 5.3 Policy Implications

The forecasting results carry important macro-level policy implications for Bangladesh's industrial development pathway. While the projected near-achievement of the per capita manufacturing value added target reflects improving industrial productivity, the substantial shortfall in manufacturing's share of GDP signals structural limitations in the depth and diversification of industrialization. This divergence suggests that productivity gains alone are insufficient to drive broad-based structural transformation unless accompanied by sectoral expansion and value-chain upgrading. Therefore, policymakers must prioritize industrial diversification beyond traditional labor-intensive manufacturing, foster technological upgrading, and integrate export-oriented strategies with domestic value addition. Moreover, aligning industrial policy with sustainability principles—particularly through eco-innovation, resource efficiency, and low-carbon production—will be critical to ensuring that growth in manufacturing does not compromise environmental objectives. Institutional coordination, investment in human capital, and strengthened monitoring mechanisms are equally essential to track progress toward SDG 9.2. Collectively, these policy directions underscore that achieving inclusive and sustainable industrialization by 2030 will require not incremental adjustments, but a coordinated structural transformation strategy anchored in productivity, inclusiveness, and environmental resilience.

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